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(54) Lithographic Printing Plates and Method for Processing

(57) A light sensitive coating for lithographic plates based on orthoquinone diazides and incorporating Resol resins enables positive images to be formed on the plates whether the original is positive or negative.

doesn't have halo alkyl - substituted
5 - triazine

SPECIFICATION

Lithographic Printing Plates and Method of Processing

The invention relates to lithographic printing plates and a method of processing such plates.

In the art of lithographic printing it has been accepted for a long time that a particular printed image can be produced from lithographic plates which themselves can have been produced from an original which is, respectively, positive or negative with respect to the printed image. Normally, positive-working lithographic plates are used when working from a positive original whilst, in order to effect the necessary reversal, plates of a different class, namely negative-working plates, are used when working from a negative original. The different classes of plate have chemically different light-sensitive coatings and require different developers or other processing chemicals.

In consequence of the above, a printer who may be called upon to produce a printed image from either positive or negative originals must maintain stocks of lithographic plates of each class together with the appropriate developers and other processing chemicals, and this requirement leads to significant demands for storage capacity and investment capital.

It has recently been discovered, that on lithographic plates having the same light-sensitive coating and by the use of developers of the same type, similar images can be produced from positive or from negative images, so that by the use of the discovery a printer need maintain stocks of only one type of plate and one type of developer.

One of the light sensitive coatings proposed for postive/negative processing comprises an orthoquinone diazide and a Novolak resin, but our experience shows that such a formulation does not produce a coating reliably providing for positive/negative processing.

Resol resins are of known application in the field of lithography and indeed we have incorporated these into plate coating formulations to improve the acid resistance of the substrate coated therewith. These resins, which are formed by reacting aromatic hydroxy compounds such as phenol or cresol with more than a molar equivalent of aldehyde such as formaldehyde in alkaline conditions (as opposed to the Novolaks which are formed in acid conditions from molar equivalents of hydroxy compound and aldehyde) have been found to have the quite different and surprising property of providing, when formulated with an orthoquinone diazide, and preferably a Novolak resin binder, a lithographic plate coating composition which most reliably provides for positive/negative processing.

According to one aspect of the invention therefore there is provided a light sensitive composition for coating lithographic plates to provide for positive/negative processing and comprising an orthoquinone diazide and a resol resin.

According to a further aspect of the invention there is provided a method of producing a lithographic image from a positive original by exposing to light through the positive original a lithographic plate which is coated with a light sensitive composition comprising an ortho-quinone diazide and a Resol resin and developing the plate with an alkaline based developer so that the coating is removed from the irradiated areas of the plate.

According to yet a further aspect of the invention there is provided a method of producing a lithographic image from a negative original by exposing to light through the negative original a lithographic plate coated with a light sensitive composition comprising an ortho-quinone diazide and a Resol resin subsequently heating the plate so as to convert the coating in the irradiated areas to a form insoluble in alkali, thereafter further exposing the plate overall to light so that the areas not previously irradiated are rendered alkali-soluble whereas the areas previously irradiated remain insoluble in alkali, developing the plate with an alkali-based developer so as to remove the coating from those areas of the plate where it is rendered soluble by the further exposure.

The resol resin may be a Phenol formaldehyde resin or a Cresol formaldehyde resin. Preferably the composition also includes a binder such as a Novolak resin and it may also include colouring agents or other additives.

The method of producing an image from a negative original may further comprise the step, after removal of the coating by the developer, of further heating the plate for preferably about 10 minutes at about 220°C to improve the solvent resistance of the plate.

The invention will now be more fully described by reference to non-limiting examples. The light sensitive component of the composition of the invention comprises an orthoquinone diazide, and in particular one of the naphthalene series such as are described in the book "Light Sensitive Systems" by J. Kosar. The compositions also comprise at least one resol resin, the function of which will be described below, and one or more from a group of Novolak resins comprising phenol formaldehyde resins or cresol formaldehyde resins to act as a binder to impart strength to the coating.

The proportions of the components in the coating composition, expressed by percentage in the dried coating are:

3) Orthoquinone diazide photosensitiser	5—95%by wt.
1) Novolak resin	0.1—95% by wt.
2) Resol Resin	0.1—&95% by wt.

Examples of Phenol Formaldehyde Novolak resins which may be used in the coating of Bakelite R5468/1, and Bakelite R10840 and

Alnovol PN320. (Bakelite and Alnovol are trade marks).

Examples of Phenol or Cresol Formaldehyde Resol resins, which may be used in the coating are Bakelite R5363, Bakelite R17620, Bakelite R10282 and Kelrez 40—152. (Bakelite and Kelrez are trade marks).

The light sensitive coating compositions are applied to any suitable substrate which will form the basis of a printing plate; metals such as Aluminium or Zinc, Paper and Paper laminates, Foils laminated on plastic or polyester bases, and other materials such as Acetate or Polycarbonates.

For our purposes we prefer the use of Aluminium, which may or may not br roughened, by for example electrochemical graining, or mechanically by means of brushing. The surface may also be anodised or otherwise surface treated, to form a hydrophilic surface suitable for lithographic printing.

The light sensitive coating would be applied to achieve a layer of between 0.1 to 10 grams per m2 dry.

To produce a positive image or a positive original, the light sensitive coating is exposed through the positive original using a suitable actinic light source. Suitable sources include metal halide, mercury vapour and xenon types and UV tubes. It is understood that when parts of the light sensitive coating are irradiated by actinic light, the orthoquinone diazide in those parts decomposes to form carboxyl groups which are then capable of being removed by an alkaline developer. Thus, when the coating is subsequently developed with an aqueous alkaline solution, the solution removes coating from those areas which have been struck by the light and leaves those areas not struck by the light as the required positive image which may then, for example, be used in a printing process.

The developing solution is of pH 10.0 and over and may comprise of alkaline salts such as sodium or Potassium Hydroxide, Sodium or Potassium Silicate, phosphates such as Trisodium Phosphate. Also included in the developer may be a surfactant or wetting agent to improve the efficiency of the developer.

The temperature of developer is 5—40°C; preferably 10—30°C.

To produce a positive image from a negative original, the light sensitive coating is exposed through the negative original using a similar light source and the coating is then heated at a temperature from 60—100°C for between 10 seconds and 30 minutes. The heating may be performed by hot air, hot liquid or infra-red or other suitable radiation.

It has been shown experimentally that the result of the heating is to convert the exposed but not, be it noted the unexposed, areas of the coating back to a form is insoluble in alkali, and it is believed that the conversion process is dependent on the presence of the Resol resin.

The result was not expected because the Resol resin was originally introduced to improve the acid resistance of the base or substrate coated by the composition. The Resol resins are known to be heat hardening and it is thought that this property may be responsible for the insolublisation of the exposed areas by heating.

The heating does not render the unexposed parts insensitive to subsequent irradiation. Accordingly when, after the heating, the plate is then subjected to a second, overall, exposure those parts and only those parts, of the plate not struck by light in the first exposure are rendered soluble in alkali. The coating is then developed with an aqueous alkali solution which removes the coating from those areas exposed by the second exposure but not exposed during the first exposure. The removal of these areas of coating results in a positive copy image as required for example for printing.

The plate produced from the negative original may be baked for 10 mins at 220°C further to increase the printing capability, and improve the solvent-resistance of the plate. This process has not previously been applied to negative plates.

Example 1

An electrochemically grained, anodised aluminium plate was coated with a solution comprising 3 parts of the Guaiacyl ester of 1,2 Naphthoquinone diazide (2) 5 Sulphonic acid 6.5 parts of a Phenol Foraldehyde Novolak Resin (Bakelite R5468/1), 0.5 parts of a Cresol Formaldehyde Resol, (Bakelite R5363) dissolved in 90 parts of ethylene glycol monoethyl ether, to give a dry coating weight of 2.55 gms/m². The resulting light sensitive plate was cut in two pieces.

One piece was exposed through a positive original in a vacuum frame for 2 minutes to 5KW Metal Halide Lamp, 140 cms distant.

The plate was then developed with a solution of 5% Sodium Silicate in water for 1 minute, in order to remove the exposed areas of coating. The areas of coating which had not been exposed to the light, remained as the positive image areas.

The other piece of plate was exposed through a negative original in a vacuum frame for 2 minutes to a 5KW Metal Halide Lamp, 140 cms distant.

The plate then heated for 2 minutes in a hot air circulating oven at 120°C. The plate was then exposed overall for 2 minutes to the Metal Halide Lamp and then developed with a solution of 5% Sodium Silicate in water for 1 minute.

The coating areas which had not been struck by the light in the first exposure, but had been exposed in the second overall exposure were removed by the developer, whereas the areas which had been exposed to the first exposure and also the second overall exposure were not developed away, and formed a positive copy of the negative original.

Both of the two processed pieces of plate were found to give satisfactory results as lithographic printing plates.

Example 2

Electrograined anodised plate was coated with 3.5 parts of Guaiacyl Ester of 1,2 Naphthoquinone diazide (2) 5 sulphonic acid, 5 parts of a Novolak resin (Bakelite R10840) 1.5 parts of a Resol Resin (Bakelite R5363) and 0.01 parts of a dyestuff (Crystal Violet SC) dissolved in 90 parts ethylene glycol monoethyl ether to obtain a dry coating weight of 1.5gm/m².

The resulting light sensitive plate was then cut in two pieces.

One piece was exposed through a positive original to a 5KW Metal Halide Lamp, 140 cms distant, for 75 seconds. The plate was then developed with a 5% solution of Sodium Silicate in water, a positive image plate being formed.

The other piece of plate was exposed through a negative on the same equipment for 75 seconds. The plate was then heated in a hot air oven for 1 minute at 140°C. The plate was then exposed overall for 75 seconds to the light source and then developed with the 5% sodium silicate solution. A positive copy image was produced from the negative original.

Both of the two processed plates were found to give satisfactory results as lithographic printing plates.

Example 3

A coating was prepared containing 7 parts of the m tolyl ester of 1,2 naphthoguinone diazide (2) 5 Sulphonic Acid, 3 parts of a Resol (Bakelite R5363) and 0.05 parts of a dyestuff (Crystal Violet SC) dissolved in 90 parts of ethylene glycol monoethyl ether. This solution was applied to an electrograined anodised plate to give a dry coating weight of 2.8 gms/m².

One piece of the coated plate was exposed through a positive original and exposed for 2 minutes using the same light source as in Example 1. The plate was then developed with 5% Sodium Silicate in water. The resulting plate was a positive copy of the positive original.

Another piece of the plate was exposed through a negative original for 2 minutes using the same light source. The plate was then heated for 2 minutes at 120°C in hot air oven, exposed overall for 2 minutes using the same equipment as above, and then developed with a solution of 5% Sodium Silicate in water. The resulting plate was a positive copy of the negative original.

Both of the two processed plates were found to give satisfactory results as lithographic printing plates.

Claims

1. A light sensitive composition for coating lithographic plates to provide for positive/negative processing and comprising an orthoquinone diazide and at least one resol resin.

2. A composition according to Claim 1 wherein the or each Resol resin is a Phenol formaldehyde resin.

3. A composition according to Claim 1 wherein the or each Resol resin is a Cresol formaldehyde resin.

4. A composition according to any one Claims 1—3 and further including a binder such as Novolak resin.

5. A method of producing a lithographic image from a positive original by exposing to light through the positive original a lithographic plate which is coated with a light sensitive composition according to one of Claims 1—4 and developing the plate with an alkaline based developer so that the coating is removed from the irradiated areas of the plate.

6. A method of producing a lithographic image from a negative original by exposing to light through the negative original a lithographic plate coated with a light sensitive composition according to any of Claims 1—4, subsequently heating the plate so as to convert the coating in the irradiated areas to a form insoluble in alkali, thereafter further exposing the plate overall to light so that the areas not previously irradiated are rendered alkali-soluble whereas the areas previously irradiated remain insoluble in alkali, developing the plate with an alkali-based developer so as to remove the coating from those areas of the plate where it is rendered soluble by the further exposure.

7. A method according to Claim 6 wherein the heating of the plate is at a temperature in the range 60—80°C.

8. The method of producing an image from a negative original according to Claim 6 or Claim 7 and further comprising the step, after removal of the coating by the developer, of further heating a plate for about 10 minutes at about 220°C to improve the solvent resistance of the plate.

9. A light sensitive composition for coating lithographic plates to provide for positive/negative processing substantially as described.

10. A method of producing a lithographic image substantially as described.

11. A lithographic plate bearing an image produced by a method substantially as described.

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